INSTRUCTIONS

CLEANING DIESEL ENGINE COOLING SYSTEM (FOR OVERSEAS LOCOMOTIVES)

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ALLIED PUBLICATIONS

Water Treatment GET-2594

INTRODUCTION

Rust deposits can accumulate on the interior surfaces of locomotive cooling systems. This may be due to operation with improper or insufficient water treatment. It may also happen when a locomotive is stored for a period of time without proper preparation for storage.

Hard-water scale deposits may also form. These are particularly troublesome in clogging the lube-oil cooler tubes; possibly causing cavitation of the water pump and leading to low water pressure shutdowns on the road.

The citric-acid cleaning process described in this Maintenance Instruction has been developed with railroad cooperation. It has been found effective in removing both rust and hard-water scale deposits.

INITIAL INSPECTION AND TESTING

Before the regular treated, cooling water is drained, make a visual inspection to determine how much the system may be contaminated with oil. **If the interior surfaces have an appreciable amount of oil contaminating them, cleaning with an alkaline compound will be necessary prior to the rust and scale cleaning.**

Appearance of the water-storage tank sight glass is one indicator. Another check is to determine if free oil is floating on top of the water in the storage tank. With the engine shut down, remove the water storage tank fill cap. Using a pail, catch some of the initial flow of water that comes out and inspect for free oil floating on top.

WARNING: ***If the cooling system is full, water will flow out this fill pipe with the engine shut down. Take care to avoid being scalded by hot water.***

Install a manometer or dual-reading (vacuum and pressure) gage at the boss in the large pipe between the bottom of the lube-oil cooler and the water pump inlet. The connections between the boss and the gage or manometer must be air tight with the hose nearly vertical from the pipe boss. Preferably the hose should be transparent so if the connections leak, water will be seen to rise in the tubing. Make a test of the water pump inlet vacuum as follows:

1. Fill to FULL MARK at IDLE
2. Remove the water tank pressure cap
3. Bring the engine to full speed — no load, with water tank temperature at 140 to 170 F
4. Read the gage or manometer.

If the water side of the lube-oil cooler is relatively clean, the reading should be very nearly 0 psi. If the vacuum is greater than 2 in. Hg (1 psi), remove and clean the lube-oil cooler before proceeding with the rust and scale acid cleaning.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Verify numbers for parts, tools, or material by using the Renewal Parts or Tool Catalogs, or contact your General Electric representative for assistance. Do not order from this publication.

GENERAL ELECTRIC

NOTE: ***If no pipe boss is available for installation of the gage or manometer, install one according to the following procedure:***

1. ***Stop the engine. Do not drain the cooling water.***
2. ***Weld a 3/8 or 1/2-in. pipe coupling to the pipe between the base of the lube-oil cooler and the water pump inlet. Make sure the weld is water tight. Locate the coupling so a gage may easily be installed and conveniently read.***
3. ***While keeping the gage or a pipe plug near at hand, drill a 1/8-in. hole inside the coupling into the pipe. Do not damage the coupling threads while drilling. When water starts to gush out as the drill breaks through, chips will be washed out.***
4. ***Install the gage (or pipe plug) to prevent loss of cooling water.***

CLEANING OIL RESIDUE

If the cooling system is sufficiently contaminated with oil, then alkaline cleaning before acid descaling is deemed necessary. The following procedure is recommended:

1. Drain the treated water, disposing of it according to local practice.
2. In a large mixing tank, mix a medium alkaline cleaning compound (see RECOMMENDED USA CLEANING COMPOUNDS) in the ratio of 1 pound to 5 gallons of water. Agitate with air or some other means to thoroughly mix the solution.

WARNING: ***While the recommended alkaline solution is quite mild, personnel should be adequately protected with face shield, rubber gloves and boots, a suitable apron and other customary safety equipment.***

NOTE: ***If hot water is not available, it may be heated in the locomotive by filling it with fresh untreated water, operating the engine with the radiator shutters closed until the water is hot, and then draining it into the mixing tank for addition of the alkaline solution.***

3. Pump the citric-acid solution into the locomotive. Start the engine and bring it up to 180 F water temperature as read on the tank gage (with water in the radiators). Block air inlets as necessary to get the temperature. Then drop load, but run the engine at Notch 8 for one to two hours at this temperature to clean the tank.

   The citric-acid reaction with hard water deposits will cause violent foaming, possibly resulting in water pump cavitation. To cut down on the foaming, after starting the engine, carefully remove the water fill cap and add five (5) drops of anti-foam solution. General Electric Type AF-60 silicone anti-foam has been tried and found to work well.

4. It is necessary to raise the water temperature to enable the akaline cleaning compound to become optimum as a cleaning agent. To accomplish this effectively, close and pin radiator shutters. Run engine at Notch 8, no load for approximately one hour. The solution will be circulating thru the system at approximately 190 F (89 C).
5. Shut down the engine and drain the unit. Dispose of the cleaning solution according to local practice.
6. Refill locomotive with new properly treated water per GET-2594 (water treatment).

NOTE: ***Alkaline cleaners must never exceed a concentration greater than ten percent by weight.***

ACID CLEANING SCALE AND RUST

After alkaline cleaning to eliminate oily residue has been completed, or if that cleaning is not considered necessary, proceed with acid descaling as detailed in the following paragraph:

1. If it is not already empty, drain the treated cooling water from the system. Dispose according to local practice or place in a holding tank if acceptable for later reuse.
2. Mix a citric-acid cleaning solution in the ratio of 100-pounds granular citric acid to 400 gallons of water. Agitate with air or other means to thoroughly mix the solution.

NOTE: ***Granular (crystalline) citric acid is available from Chas. Pfizer & Co., Inc., 235 East 42nd St., New York, N.Y. 10017, and is widely sold through major chemical distributors. It can be purchased in both 100-pound bags and 250-pound drums.***

WARNING: ***While the recommended citric acid cleaning solution is quite mild, personnel should be adequately protected with face shields, rubber gloves and boots, a suitable apron and other customary safety equipment.***

3. Pump the citric-acid solution into the locomotive. Start the engine and bring it up to operating water temperature. Run the engine for one to two hours.
4. From time to time, inspect the condition of the citric-acid cleaning solution by observing the water storage

tank sight glass. If the color is light yellow, light greenish-yellow, or has only a slight brownish tinge, the solution can be assumed to still be active. When the color becomes reddish-brown, the solution is no longer effective and must be discarded. Mix a new batch and continue to clean for another one to two hours. Do not add new citric acid to the used solution.

5. When cleaning is complete, drain the citric-acid solution into a holding tank, if considered acceptable for further use, or dispose of it according to local practice. (Because this solution is only a mild acid, disposing through the same facilities as mild alkaline cleaners is generally practicable. The acid will tend to neutralize the alkali.)

6. Refill the cooling water system with fresh, untreated water. Heat the system up per Steps 3 and 4 under CLEANING OIL RESIDUE section to rinse the radiators. Run the engine for about 15 minutes. Drain the rinse water.

7. Visually inspect the interior of the cooling system as well as possible; particularly in the vicinity of the water inlet to the lube-oil cooler. Interior surfaces should be rust and scale free. If not, repeat the cleaning procedure.

NOTE: ***Experience indicates one batch of cleaning solution may be used to clean as many as six cooling systems, depending on conditions.***

NOTE: ***The mixing and storage tank for the citric-acid solution should have an anti-corrosive lining, such as glass, rubber or appropriate paint.***

NOTE: ***The pump used for transferring the citric-acid solution should also be made of materials which will resist corrosion.***

TESTING AND PREPARATION FOR SERVICES

Immediately following cleaning, and as soon as all openings in the system have been closed, recharge the engine cooling system with fully treated water and bring the engine up to operating temperature. Use Steps 3 and 4 under CLEANING OIL RESIDUE section so the radiators are protected. Refer to Maintenance Instruction GET-2594 for further information on treatment concentrations.

Proper water treatment is considered very important, since the chemicals will impregnate the interior surfaces to prevent further rusting.

Reinstall the pressure gage or manometer as described under INITIAL INSPECTION AND TESTING section, and operate the engine with the fill cap removed at full speed — no load. A reading at the water pump inlet should be very nearly 0 psi. Any appreciable vacuum reading indicates the water side of the lube-oil cooler is blocked to some extent. Release for service with this condition may lead to low water-pressure shutdown on the road. Make corrections to the cooler as necessary.

When satisfactory near-zero readings at the water pump inlet are obtained, the locomotive may be released for service.

Recheck the water treatment concentration after approximately one week of service, bringing it back to normal concentration as indicated.

RECOMMENDED USA CLEANING COMPOUNDS

Manufacturer	Product	Concentration
Cleaning Solution for Radiator Exterior and System Interior:		
Turco Products, Inc. . . . . Carson, CA 90745	TREC	2 oz. per gal.
Oakite Products, Inc. . . . . 50 Valley Rd. Berkeley Hts., N.J. 07922	Penetrant . . .	2 oz. per gal.
Descaling Solution for System Interior:		
Turco Products, Inc. . . . . Carson, CA 90745	Descaler	5% by volume
Oakite Products, Inc. . . . . 50 Valley Rd. Berkeley Hts., N.J. 07922	Oakite 32 . . .	10% by volume
Neutralizing Solution for System Interior after Descaling:		
Turco Products, Inc. . . . . Carson, CA 90745	TREC	1/2 oz. per gal.
Oakite Products, Inc. . . . . 50 Valley Rd. Berkeley Hts., N.J. 07922	Penetrant . . .	1/2 oz. per gal.